Name ICEY Class _____ Date _____

w/ Activity 2.9

Modeling a Decay Series

#P/#N SO UNBALANCED

Background Information

Atoms of certain elements are unstable. This means that they cannot remain in their original form. To become stable, they may undergo a process called radioactive decay. Radioactive decay is the spontaneous breakdown of an unstable atomic nucleus. During radioactive decay, three types of radiation may be emitted from the nucleus. The three types of radiation are called alpha particles, beta particles, and gamma rays.

In some cases, even after the atom undergoes radioactive decay, the nucleus is still unstable. When this happens, the nucleus again decays. This process continues until a stable nucleus is formed. This pattern of radioactive decay is called a decay series. In this activity, you will model part of the decay series for uranium-238.

THIS IS WHAT WE'RE LOOKING AT TODAY

Materials:

about 250 small dried beans
dark-colored food dye or spray paint
6 large paper plates
yellow construction paper
ruler
scissors
glue
marking pen

Procedure

1. Color about 100 small dried beans. You can do this either by soaking the beans overnight in water that has been colored with dark food dye or by spraying the beans with paint. The colored beans represent protons. Collect another 150 beans to represent neutrons.
2. Cut five squares of yellow construction paper, making each square about 6 cm × 6 cm.
3. Line up six paper plates (LAMINATED SHEETS) in a row, ~~leaving about 15 cm between plates.~~
4. Write the symbol U-234 and 92-P/142-N on the first plate. Place 92 colored beans and 142 uncolored beans on the plate.
5. Take 2 colored beans and 2 uncolored beans off the plate and place them on a yellow square. This square represents an alpha particle. Place this yellow square between the first and second plate.
6. Write Th-230 and 90-P/140-N on the second plate. Take the beans from the first plate and place them on the second plate. Leave the first plate in its original position.
7. Take 2 colored beans and 2 uncolored beans off the second plate and place them on another yellow square. Place this yellow square between the second and third plates.
8. Write Ra-226 and 88-P/138-N on the third plate. Take the beans from the second plate and place them on the third plate. Leave the second plate in its position.

9. Remove 2 colored beans and 2 uncolored beans from the third plate and place them on another yellow square. Place the square between the third and fourth plates.
10. Write Rn-222 and 86-P/136-N on the fourth plate. Move the beans from the third plate onto the fourth plate.
11. Remove 2 colored beans and 2 uncolored beans from the fourth plate. Glue them to another yellow square. Place this square between the fourth and fifth plates.
12. On the fifth plate, write Po-218. Then write 84-P and 134-N. Move the beans from the fourth plate onto the fifth plate.
13. From the fifth plate, take 2 colored beans and 2 uncolored beans and ~~glue them~~ to ~~the last yellow square.~~ Place this square between the fifth and sixth plates.
14. On the sixth plate, write Pb-214; then write 82-P and 132-N. Move the beans from the fifth plate onto the sixth plate. Try to arrange the beans so you can still see the numbers you have written.

STOP! Have your arrangement checked by your teacher!

Critical Thinking and Application

1. If each of the paper plates represents an atomic nucleus, how many different nuclei were involved in this series? Write the names of the elements in order with the mass number of each.

6 URANIUM-234, THORIUM-230, RADIUM 226, RADON-222, POLONIUM-218 AND LEAD-214

2. How many alpha particles were emitted each time an element changed? How many all together?

1, 5

1

3. What subatomic particles make up an alpha particle?

2 PROTONS
2 NEUTRONS

4. How did the emission of an alpha particle affect the atomic number of a nucleus? The mass number?

THE ATOMIC MASS DECREASED BY 4 AFTER EMITTING 1 α PARTICLE

5. Lead-214 is a radioactive isotope of lead. What do you think will happen to this nucleus? Why?

IT WILL CONTINUE TO UNDERGO DECAY - BUT WILL SWITCH TO BETA DECAY BECAUSE LEADS ATOMIC # IS LESS THAN 83